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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/026,953 | 12/27/2001 | K.C. Chan | 401529/M&C | 7340 |
| 23548 | 7590 | 04/15/2004 | EXAMINER | |
| LEYDIG VOIT & MAYER, LTD 700 THIRTEENTH ST. NW SUITE 300 WASHINGTON, DC 20005-3960 | | | MUTSCHLER, BRIAN L | |
| | | ART UNIT | PAPER NUMBER | 1753 |
| DATE MAILED: 04/15/2004 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|--------------------|--------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/026,953 | CHAN ET AL. |
| | Examiner | Art Unit |
| | Brian L. Mutschler | 1753 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on _____.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-8 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
 5) Claim(s) ____ is/are allowed.
 6) Claim(s) 1-8 is/are rejected.
 7) Claim(s) ____ is/are objected to.
 8) Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on ____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

| | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>20020415</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 1, 4, 5, and 8 objected to because of the following informalities:
 - a. Claim 1 (line 2), claim 5 (lines 3 and 5), and claim 8 (lines 3 and 5) each recite the use of at least one anode. It is preferred that the term “anode” be changed to “electrode” because an anode implies a certain polarity. However, since the claims later recite “positive portions” and “negative portions”, the term “anode” is not always an accurate description of the function. During the process, the anode is performing the functions of both an anode (during the positive portions) and a cathode (during the negative portions). Therefore, it is suggested that the term “anode” be changed to “electrode” because an electrode may perform both anodic functions and cathodic functions.
 - b. In claim 4 at lines 3, 5, and 6, it is suggested that the term “value” be changed to --current density--.
 - c. In claim 8 at lines 8, 9, and 10, it is suggested that the term “value” be changed to --current density--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 2-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 recites the limitation "a cyclic alternating type" in line 2. The term "type" renders the scope of the claim indefinite because it is not clear what is encompassed by the term. It is suggested that the phrase be changed to --a cyclic alternating waveform--. Similar limitations also appear in claims 3, 4, and 6-8.

Claim 4 recites the limitation "the forward portion" in line 4. There is insufficient antecedent basis for this limitation in the claim. It was assumed that the forward portion refers to the positive portion. The same limitation also appears in claim 8 at line 8.

Claims 4 and 8 are also indefinite because it states that there are two portions, but three peak values are claimed. What is the relationship between the spikes, the positive portion, and the negative portion? In addition to the assumption that the forward portion is the same as the positive portion (i.e., the spikes are part of the positive portion), it was also assumed that the positive portion actually consists of two sub-portions, the triangular shaped portion and the spikes.

Claim 5 recites the limitation "the anode nodes" in line 5. There is insufficient antecedent basis for this limitation in the claim. It appears that the phrase should be changed to --the anode--. A similar limitation also appears in claim 8 at line 5.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Bacon et al. (U.S. Pat. No. 4,466,864).

Regarding claims 1 and 5, Bacon et al. disclose a method for electroplating objects by passing a complex waveform between an electrode **61** and the object **34** to be plated in an electroplating bath solution **45** (col. 8, lines 22-36).

Regarding claim 2, the waveform comprises a positive (plating) portion and a negative (deplating portion) (col. 8, lines 22-36).

Since Bacon et al. teach all of the limitations recited in the instant claims, the reference is deemed to be anticipatory.

6. Claims 1, 2, 5, and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by WO 99/54527 ("WO '527").

Regarding claims 1, 2, and 5, WO '527 discloses a method of electroplating an object passing a complex waveform between an electrode **90** and the object **48** (page

22-25). The complex waveform comprises positive (plating) portions and negative (dissolution) portions (page 23).

Regarding claim 7, the positive portion comprises a short higher current density spike to nucleate the electroplated layer (page 22-23). The method further comprises vibrating the object **48** (page 14).

Since WO '527 teaches all of the limitations recited in the instant claims, the reference is deemed to be anticipatory.

7. Claims 1-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Reid et al. (US 2001/0015321 A1).

Regarding claims 1 and 5, Reid et al. disclose a method for electroplating an object using a complex current waveform, which inherently requires an electrode to complete the current path between the object and the power source. The object is disposed within an electroplating bath (par. [0010]).

Regarding claims 2-4 and 6, the waveform comprises a positive (plating or fill) portion and a negative portion (par. [0021] to par. [0030]). The positive portion comprises a ramped (triangular-shaped) portion and spikes (par. [0025] to par. [0030]). The ramped portion has a peak current density between 15 mA/cm² and 75 mA/cm² (1.5 ASD to 7.5 ASD) (par. [0029]). The spikes are short cathodic pulses that have a current density from about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]). The negative portion has a current density of about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]).

Since Reid et al. teach all of the limitations recited in the instant claims, the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 3, 4, 6, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 99/54527 in view of Reid et al. (US 2001/0015321 A1).

WO '527 teaches a method having the limitations recited in claims 1, 2, 5, and 7 of the instant invention, as explained above in section 6.

Regarding claims 4 and 8, WO '527 further teach that the spikes have a current density of 50 to 180 mA/cm² (5 ASD to 18 ASD), the positive portions have a current density of 5 to 40 mA/cm² (0.5 ASD to 4 ASD), and the negative portions have a current density of 5 to 80 mA/cm² (0.5 ASD to 8 ASD) (page 22-23).

The method of WO '527 differs from the instant invention because WO '527 does not disclose the following:

- a. The positive portion is triangular shaped, as recited in claims 3, 4, 6, and 8.
- b. The triangular shaped portion has a peak value of substantially 5 ASD, as recited in claims 4 and 8.

c. The negative portion has a peak value of substantially 12 ASD, as recited in claims 4 and 8.

Regarding claims 3, 4, 6, and 8, Reid et al. discloses a method for electroplating using a waveform comprising a positive (plating or fill) portion and a negative portion (par. [0021] to par. [0030]). The positive portion comprises a ramped (triangular-shaped) portion and spikes (par. [0025] to par. [0030]). Ramping the current provides smooth transitions between the different waveform portions (par. [0024]). The ramped portion has a peak current density between 15 mA/cm² and 75 mA/cm² (1.5 ASD to 7.5 ASD) (par. [0029]). The spikes are short cathodic pulses that have a current density from about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]). The negative portion has a current density of about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]). Reid et al. teach that the current densities are selected according to the geometry of the substrate (par. [0011]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the positive portion of WO '527 to use a ramped (triangular-shaped) portion as taught by Reid et al. because using a triangular-shaped portion provides smooth transitions between the waveform portions.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the peak current densities of the positive and negative portions in the method of WO '527 to use the current densities taught by Reid et al. because the current density in an electroplating method is a result effective variable that depends on the geometry of the substrate.

10. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reid et al. (US 2001/0015321 A1) in view of Bacon et al. (U.S. Pat. No. 4,466,864).

Reid et al. teaches a method having the limitations recited in claims 1-6 of the instant invention, as explained above in section 7.

Regarding claim 8, Reid et al. disclose a method for electroplating an object using a complex current waveform, which inherently requires an electrode to complete the current path between the object and the power source. The object is disposed within an electroplating bath (par. [0010]). The waveform comprises a positive (plating or fill) portion and a negative portion (par. [0021] to par. [0030]). The positive portion comprises a ramped (triangular-shaped) portion and spikes (par. [0025] to par. [0030]). The ramped portion has a peak current density between 15 mA/cm² and 75 mA/cm² (1.5 ASD to 7.5 ASD) (par. [0029]). The spikes are short cathodic pulses that have a current density from about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]). The negative portion has a current density of about 25 to 250 mA/cm² (2.5 ASD to 25 ASD) (par. [0025]).

The method of Reid et al. differs from the instant invention because Reid et al. do not disclose vibrating the object or agitating the bath solution, as recited in claims 7 and 8.

Bacon et al. disclose a method for electroplating an object using a complex waveform, as well as agitating the solution to maintain the concentration of the electrolyte (abstract; col. 9, lines 17-28).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Reid et al. to agitate the plating solution because agitating the solution makes the solution concentration uniform.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Pat. No. 6,491,806 Dubin et al.

U.S. Pat. No. 6,251,250 Keigler

U.S. Pat. No. 6,099,711 Dahms et al.

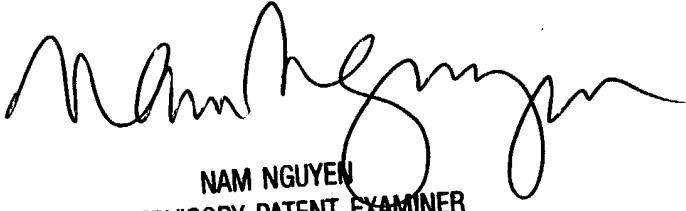
U.S. Pat. No. 6,071,398 Martin et al.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (571) 272-1341. The examiner can normally be reached on Monday-Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

blm
April 9, 2004


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SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700